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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/561,303	SHINGYOHUCHI ET AL.	
	Examiner	Art Unit	
	HENOK LEGESSE	2861	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 June 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *07/24/2008 and 03/27/2008*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-3, 7-17 are rejected under 35 U.S.C. 102(b) as being anticipated by Kusunoki et al.(US 2004/0207671 / WO 2003/026897).

Regarding claim 1, Kusunoki et al teaches an image formation apparatus (fig.4) capable of forming a relatively large ink drop by sequentially discharging a plurality of ink drops from an ink drop discharging head (paragraph0114, fig.6), the image formation apparatus comprising:

pressure generating means (52, fig.6) for discharging one or more of the sequential ink drops other than an ink drop that is not followed by any more of the ink drops in a given printing cycle (the last ink drop) (see fig.11a-11b and paragraphs 0114-0119) at an interval <u>substantially</u> equal to (n+1/2) x Tc, wherein the interval at which said one or more of the sequential ink drops is discharged in said given printing cycle is substantially equal to (n x Tc) + (Tc/2) such that the sequential ink drops merge before reaching a print target medium (paragraph 0119) (**Examiner Note**, (n x Tc) + (Tc/2) = (n + 1/2) x Tc i.e. the two limitations are exactly the same),

where n is an integer equal to or greater than 1, and Tc represents a resonance cycle of a pressurized ink chamber of the image formation apparatus, the interval being measured from when a corresponding preceding ink drop is discharged (see fig.11a-11b and equation1 in paragraph 0117; each driving pulse in fig.11a discharges an ink droplet at an interval equals to tr + Pw+tf+td = nxTs where n is an integer equal to or greater than 1, and Ts represents a resonance cycle of a pressurized ink chamber. The value of nxTs is <u>substantially</u> equal to (n+0.5) x Tc which can also be rewritten as (n x Tc) + (Tc/2) as shown above for an integer n that is equal to or greater than 1, especially for high values of n).

Regarding claim 2, Kusunoki et al further teaches the one or more of the ink drops other than the last ink drop are discharged at an interval substantially equal to 1.5 x Tc (see the equation1 in paragraph 0117, tr + Pw+tf+td = nxTs. When n is equal to 1 or 2 the interval is substantially equal to 1.5 x Tc).

Regarding claim 3, Kusunoki et al further teaches ink drops other than the one or more ink drops that are discharged at an interval substantially equal to (n+1/2) x Tc are discharged at an interval nearly equal to n x Tc (see fig.11a-11b and equation1 in paragraph 0117, each driving pulse in fig.11a discharges an ink droplet at an interval equals to nxTs, which is also substantially equal to (n+0.5) x Tc).

Regarding claim 7, Kusunoki et al further teaches wherein four or more of the sequential ink drops (fig.11, paragraphs 0114) merge during flight to form one of the relatively large ink drops (paragraph 0119).

Regarding claim 8, Kusunoki et al further teaches a waveform containing driving pulses for discharging the sequential ink drops (fig.12) includes a waveform for suppressing a residual vibration after a driving pulse for discharging the last ink drop (paragraphs 0124,0129).

Regarding claim 9, Kusunoki et al further teaches the waveform for suppressing the residual vibration (figs.12, 13; paragraph 0124) is provided within an elapsed time equivalent to Tc (fig.14) after the last ink drop is discharged (paragraphs 0129,0130).

Regarding claim 10, Kusunoki et al further teaches a medium-sized ink drop (Mj2, fig.16; paragraph 0144) and a small-sized ink drop (Mj3, fig.16; paragraph 0138) are each formed by selecting a part of driving pulses (fig.15) for forming the relatively large ink drop (Mj1, fig.16; paragraph 0141-0142).

Regarding claim 11, Kusunoki et al further teaches the driving pulses include a waveform for vibrating a meniscus without causing an ink drop to be discharged (paragraph 0136).

Regarding claim 12, Kusunoki et al further teaches the driving pulses (figs.10, 11) include a section wherein a voltage is applied to the pressure generating means (52,fig.6) for pressurizing ink in the pressurized ink chamber (46) (paragraphs 0110,0139).

Regarding claim 13, Kusunoki et al further teaches the pressure generating means (52,figs.6, 7) is a piezoelectric device (paragraph 0092), and the piezoelectric device (52) is recharged in the section wherein said voltage is applied (paragraph 0093).

Regarding claim 14, Kusunoki et al further teaches wherein the pressure generating means (52,fig.6) for generating the pressure for pressurizing the ink of the pressurized ink chamber is a piezoelectric device (paragraph 0092), a displacement direction of which is d33 (arrow A in fig.7, paragraph 0093).

Regarding claim 15, Kusunoki et al further teaches support sections (64,fig.8) of the piezoelectric device (fig.8) support partitions of the pressurized ink chamber (46) (see also figs.6, 7; there is a support structure to support ink chamber 46).

Regarding claim 16, Kusunoki et al further teaches wherein additional ink drops other than the one or more ink drops that are discharged at an interval substantially equal to (n+1/2) x Tc are discharged at an interval substantially equal to n x Tc, and

said additional ink drops merge with the one or more ink drops that are discharged at an interval nearly equal to (n+1/2) x Tc (see fig.11a-11b, equation1 in paragraph 0117, and paragraph 0119; plurality of ink drops are discharged sequentially by sequential pulses at an interval nxTs where n is an integer equal to or greater than 1 and Ts represents a resonance cycle of a pressurized ink chamber. The value of interval nxTs is substantially equal that of (n+0.5) x Tc especially for high integer values of n. The plurality of ejected ink drops merge in flight forming large ink drop. Note also the limitation “merge” in this claim does not specifically mention the location of the merge, so the merge can be interpreted to mean the claimed ink drops ejected merge on the medium surface, which is obviously true irrespective of the time interval between the drops).

Regarding claim 17, Kusunoki et al further teaches wherein a predetermined interval between first and second ink drops of the sequential ink drops is substantially equal to1.5 x Tc such the first and second ink drops merge before reaching a print target medium (see fig.11a-11b, equation1 in paragraph 0117, and paragraph 0119; plurality of ink drops are discharged sequentially (first drop, second drop, ...) by sequential pulses at an interval nxTs where n is an integer equal to or greater than 1 and Ts represents a resonance cycle of a pressurized ink chamber. For at least the values of n equals to 1 and 2, the value of interval nxTs is substantially equals to 1.5 x Tc. The plurality of ejected ink drops merge in flight forming large ink drop).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 4 - 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kusunoki et al. (US 2004/0207671 / WO 2003/026897).

Regarding claim 4, Kusunoki et al further teaches an ink drop is discharged by the pressurized ink chamber being contracted (by the rising edge of the 2^{nd},3^{rd},... pulses in figs.11, 15) after being expanded (by the falling edge of the 1^{st},2^{nd},3^{rd},... pulses in figs.11,15), where a volume of contraction (by the rising edge of the 2^{nd},3^{rd},... pulses in fig.15) is greater than a volume of expansion (by the falling edge of the 2^{nd},3^{rd},... pulses in fig.15), and where the volume of expansion may take (the term "may take" is dot a

positive limitation since it could mean it may take ... or may not take ....) a positive value or zero (see fig.15 the falling edge of the 2^{nd},3^{rd} pulse take a positive value) (see also fig.10 and paragraph 0107).

Kusunoki et al does not expressly disclose the ink drop formed by the above pulses is a first ink drop. However, it would have been obvious to one ordinary skill to rearrange the supply of the pulse elements for ejecting the first ink drop by first supplying the falling edge followed by rising edge of pulse elements as mentioned above for instance based on the type of vibrating element is used.

Regarding claim 5, Kusunoki et al further teaches a second ink drop is discharged at an interval substantially equal to (n+1/2) x Tc from the first ink drop that precedes the second ink drop (see fig.11a-11b and equation1 in paragraph 0117, each driving pulse in fig.11a discharges an ink droplet at an interval equals to nxTs, which is substantially equal to (n+0.5) x Tc).

Regarding claim 6, Kusunoki et al substantially teaches the claimed invention (see figs.11, 24, 25) except for the speed of one of the ink drops is set at greater than 3 m/s, and at a speed at which the sequential ink drops are merged. It would have been obvious to one having ordinary skill in the art at the time the invention was made to eject an ink drop at greater than 3 m/s, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233

6. Claims 1-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishikawa (US 6,254,213) in view of Matsuo et al. (US 6,488,349).

Regarding claim 1, Ishikawa teaches an image formation apparatus (figs.8,9 and controller 625 in fig.4) capable of forming a relatively large ink drop by sequentially discharging a plurality of ink drops from an ink drop discharging head (600), the image formation apparatus (figs.4,8,9) comprising:

pressure generating means (603,619,621, figs.8) for discharging one or more of the sequential ink drops other than an ink drop that is not followed by any more of the ink drops in a given printing cycle (the last ink drop) at an interval substantially equal to (n+1/2) x Tc, wherein the interval at which said one or more of the sequential ink drops is discharged in said given printing cycle is substantially equal to (n x Tc) + (Tc/2) such that the sequential ink drops merge before reaching a print target medium (paragraph 0119) (**Examiner Note**, (n x Tc) + (Tc/2) = (n + 1/2) x Tc i.e. the two limitations are exactly the same), where n is an integer equal to or greater than 1, and Tc represents a resonance cycle of a pressurized ink chamber of the image formation apparatus, the interval being measured from when a corresponding preceding ink drop is discharged (the driving wave form in fig.1 is applied to the electrodes of the ink drop discharge head 600 by the controller 625 in fig.4. The interval between the ink drop ejecting pulses in fig.1 is equal to (N + 0.5) x T).

Ishikawa does not expressly teach the sequential ink drops merges before reaching a print target medium.

However, from the same endeavor Matsuo et al teaches merging sequential ink drops (figs.7,14) before reaching a print target medium (41, fig.1) in order to form large ink drop. The ink drops are merged by ejecting the ink drops such that the later discharged ink droplet has a higher discharge velocity than that of a previously discharged ink droplet for example by adjusting voltage amplitude as shown in figs.16 and 17 (see also col. 23 line 16- col.24 line 33; by increasing the magnitude of the voltage applied so that the later discharged ink droplet has higher discharge velocity than that of the a previously discharged droplet) (also by adjusting other parameters of the wave forms as shown in figs.12,13, and 15).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the driving wave form of Ishikawa (fig.1) to cause ejections such that the sequential ink drops ejected merges before reaching a print target medium during formation of large ink drops based on the teachings of Matsuo et al (figs.14, 16, 17). The motivation is to form large ink drops and since all of the merged ink drops reaches the recording medium at the same time (at once), the merged ink drops dry uniformly which improves the uniformity, quality, of the large ink drops formed thereby enhancing the printing image quality.

Regarding claim 2, Ishikawa further teaches wherein one or more of the ink drops other than the last ink drop are discharged at an interval substantially equal to 1.5 x Tc (see fig.1, when the value of the integer N is set to be equal to 1, then the interval between the pulses becomes 1.5 x Tc).

Regarding claim 3, Ishikawa further teaches ink drops other than the one or more ink drops that are discharged at an interval substantially equal to (n+1/2) x Tc (interval (N + 0.5) x T between the ink drop ejecting pulses in fig.1) are discharged at an interval nearly equal to n x Tc (see figs.2B, 3B, 6B, and 6C; shows interval equal to even or odd integer times Tc).

Regarding claim 4, Ishikawa further teaches wherein a first ink drop is discharged by the pressurized ink chamber (613, fig.8) being contracted after being expanded, where a volume of contraction is greater than a volume of expansion, and where the volume of expansion may take a positive value or zero (in the ink drop discharge head 600 of figs.8,9, ink drops are ejected by first expanding the chamber 613 as shown in fig.9, then by contracting the chamber to its original position as shown in fig.8. see col.1, line 61- col.2, line 32 of Ishikawa. The amount of expansion and contraction can be controlled by the voltage applied to the electrodes. see figs.7B, 8, 9, 16 of Matsuo et al).

Regarding claim 5, Ishikawa further teaches a second ink drop is discharged at an interval substantially equal to (n+1/2) x Tc from the first ink drop that precedes the second ink drop (the interval between the first, second, third,..., ejecting pulses in fig.1 is equal to (N + 0.5) x T).

Regarding claim 6, Ishikawa further teaches wherein the speed of ink drops is set at greater than three m/s (see figs.2 and 3, the speed of the ink drops is 5-9 m/s in fig.2 and 20-60 in fig.3).

Regarding claim 7, Ishikawa as modified by Matsuo et al. further teaches wherein four or more of the sequential ink drops merge during flight to form one of the relatively large ink drops (Matsuo et al in figs.7, and 14 teaches the merging of 3 ink droplets to form large ink drop Q123, figs.12b, 13b, 15b, 16b, 17b teaches how to select the required number of ejecting pulses that merges to from large ink drop. Thus it is obvious to form a large ink drop by merging four or more ink drops depending on the size of the large ink drop and the merging ink drops).

Regarding claim 8, Ishikawa as modified by Matsuo et al further teaches a waveform containing driving pulses (fig.1of Ishikawa, figs.16, 17 of Matsuo et al) for discharging the sequential ink drops includes a waveform for suppressing a residual vibration after a driving pulse for discharging the last ink drop (S13 in fig.9, P15 in fig.11 of Matsuo et al).

Regarding claim 9, Ishikawa as modified by Matsuo et al further teaches the waveform for suppressing the residual vibration (S13 in fig.9, P15 in fig.11 of Matsuo et al) is provided within an elapsed time equivalent to Tc after the last ink drop is

discharged (fig.1of Ishikawa).

Regarding claim 10, Ishikawa as modified by Matsuo et al further teaches a medium-sized ink drop and a small-sized ink drop are each formed by selecting a part of driving pulses for forming the relatively large ink drop (see fig.3 of Ishikawa teaches droplets of different volume. fig.14 of Matsuo et al teaches small ink drops Q1 and Q2 formed a medium size drop Q12 and a small drop Q3 and medium drop Q12 forms large drop Q123).

Regarding claim 11, Ishikawa as modified by Matsuo et al further teaches the driving pulses include a waveform for vibrating a meniscus without causing an ink drop to be discharged (S13 in fig.9, P15 in fig.11 of Matsuo et al).

Regarding claim 12, Ishikawa as modified by Matsuo et al further teaches the driving pulses (fig.1 of Ishikawa) include a section wherein a voltage is applied to the pressure generating means (603,619 of fig.8) for pressurizing ink in the pressurized ink chamber (613) (see also figs. 6-9,11,16 of Matsuo et al).

Regarding claim 13, Ishikawa as modified by Matsuo et al further teaches the pressure generating means (603,619 of fig.8 of Ishikawa) is a piezoelectric device, and the piezoelectric device (603,619) is recharged in the section wherein said voltage is applied (figs.8,9;col.8, lines 10-25).

Regarding claim 14, Ishikawa as modified by Matsuo et al further teaches wherein the pressure generating means (603,619 of fig.8 of Ishikawa) for generating the pressure for pressurizing the ink of the pressurized ink chamber is a piezoelectric device, a displacement direction of which is d33 (figs.9; col.8, lines 10-25).

Regarding claim 15, Ishikawa as modified by Matsuo et al further teaches support sections (619 in fig.8 of Ishikawa; 15 in fig.5 of Matsuo et al) of the piezoelectric device (603,619 in fig.8 of Ishikawa; 13 in fig.5 of Matsuo et al) support partitions of the pressurized ink chamber (613 in fig.8 of Ishikawa; 4 in fig.5 of Matsuo et al).

Regarding claim 16, Ishikawa as modified by Matsuo et al further teaches wherein additional ink drops other than the one or more ink drops that are discharged at an interval substantially equal to (n+1/2) x Tc are discharged at an interval substantially equal to n x Tc, and said additional ink drops merge with the one or more ink drops that are discharged at an interval nearly equal to (n+1/2) x Tc (see fig.1 of Ishikawa, plurality of ink droplets are ejected due to the application of the driving wave form. The interval between the ink drop ejecting pulses in fig.1 is equal to (N + 0.5) x T where N is an integer and the value of interval (N + 0.5) x T is <u>substantially</u> equal that of N x T especially for high integer values of N. The plurality of ejected ink drops merge in flight forming large ink drop, Matsuo et al. Note also the limitation “merge” in this claim does not specifically mention the location of the merge, so the merge can be interpreted to

mean the claimed ink drops ejected merge on the medium surface, which is obviously true irrespective of the time interval between the drops).

Regarding claim 17, Ishikawa as modified by Matsuo et al further teaches wherein a predetermined interval between first and second ink drops of the sequential ink drops is substantially equal to1.5 x Tc such the first and second ink drops merge before reaching a print target medium (see fig.1 of Ishikawa, the interval between the ink drop ejecting pulses in fig.1 is equal to (N + 0.5) x T where N is an integer and the value of interval (N + 0.5) x T for N is equal to 1 is equal to 1.5 x T).

7. Claims 1-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kusunoki (US 2003/0001912) in view of Matsuo et al. (US 6,488,349).

Regarding claim 1, Kusunoki '912 teaches an image formation apparatus (fig.3) capable of forming a relatively large ink drop by sequentially discharging a plurality of ink drops from an ink drop discharging head (1, figs.1-3), the image formation apparatus (fig.3) comprising:

pressure generating means (15, figs.1-2) for discharging one or more of the sequential ink drops other than an ink drop that is not followed by any more of the ink drops in a given printing cycle (the last ink drop) at an interval <u>substantially</u> equal to (n+1/2) x Tc, wherein the interval at which said one or more of the sequential ink drops is discharged in said given printing cycle is substantially equal to (n x Tc) + (Tc/2) such

that the sequential ink drops merge before reaching a print target medium (paragraph 0119) (**Examiner Note**, (n x Tc) + (Tc/2) = (n + 1/2) x Tc i.e. the two limitations are exactly the same), where n is an integer equal to or greater than 1, and Tc represents a resonance cycle of a pressurized ink chamber of the image formation apparatus, the interval being measured from when a corresponding preceding ink drop is discharged (see fig.10, the interval between the consecutive ejecting pulses P2' is <u>substantially</u> equal to 1.5 x Tc which is equal to (1+1/2) x Tc ; see fig.11 the interval between the consecutive ejecting pulses P2" is equal to 1.5 x Tc which is equal to (1+1/2) x Tc; see fig.8, the interval between the consecutive ejecting pulses P2 is equal to 2.5 x Tc which is equal to (2+1/2) x Tc).

Kusunoki '912 does not expressly teach the sequential ink drops merges before reaching a print target medium.

However, from the same endeavor Matsuo et al teaches merging sequential ink drops (figs.7,14) before reaching a print target medium (41, fig.1) in order to form large ink drop. The ink drops are merged by ejecting the ink drops such that the later discharged ink droplet has a higher discharge velocity than that of a previously discharged ink droplet for example by adjusting voltage amplitude as shown in figs.16 and 17 (see also col. 23 line 16- col.24 line 33; by increasing the magnitude of the voltage applied so that the later discharged ink droplet has higher discharge velocity than that of the a previously discharged droplet) (also by adjusting other parameters of the wave forms as shown in figs.12,13, and 15).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the driving wave form of Kusunoki ‘912 (figs.8, 10, 11) to cause ejection such that the sequential ink drops ejected merges before reaching a print target medium during formation of large ink drops based on the teachings of Matsuo et al (figs.14, 16, 17). The motivation is to form large ink drops and since all of the merged ink drops reaches the recording medium at the same time (at once), the merged ink drops dry uniformly which improves the uniformity, quality, of the large ink drops formed thereby enhancing the printing image quality.

Regarding claim 2, Kusunoki ‘912 further teaches wherein one or more of the ink drops other than the last ink drop are discharged at an interval substantially equal to 1.5 x Tc (see fig.10, the interval between the consecutive ejecting pulses P2' is substantially equal to 1.5 x Tc; see fig.11 the interval between the consecutive ejecting pulses P2” is equal to 1.5 x Tc).

Regarding claim 3, Kusunoki ‘912 further teaches ink drops other than the one or more ink drops that are discharged at an interval nearly equal to (n+1/2) x Tc (see fig.10, the interval between the consecutive ejecting pulses P2' is substantially equal to (1+1/2) x Tc ; see fig.11 the interval between the consecutive ejecting pulses P2” is equal to (1+1/2) x Tc; see fig.8, the interval between the consecutive ejecting pulses P2 is equal to (2+1/2) x Tc) are discharged at an interval substantially equal to n x Tc (see fig. 4, the interval between the consecutive ejecting pulses P2 is equal to 2 x Tc;

Furthermore, in figs.8,10,11, the intervals 2.5 x Tc, 1.5 x Tc, 1.5 x Tc respectively are also substantially equal to n x Tc).

Regarding claim 4, Kusunoki '912 further teaches wherein a first ink drop is discharged by the pressurized ink chamber (11, fig.1) being contracted (by pulses P2 in figs.4,8,10,11) after being expanded (by pulses P1 in figs.4,8,10,11), where a volume of contraction (by pulses P2 in figs.4,8,10,11) is greater than a volume of expansion (by pulses P1 in figs.4,8,10,11), and where the volume of expansion may take a positive value or zero (see figs. 4,8,10,11 the expansion of chamber 11 due to pulses P1 takes a positive or zero value, and the amount of expansion and contraction can be controlled by controlling the amplitude and/or the width of pulses P1 and P2 as shown in figs.10,11 of Kusunoki and figs.7B,8,9, 16 of Matsuo et al).

Regarding claim 5, Kusunoki '912 further teaches a second ink drop is discharged at an interval substantially equal to (n+1/2) x Tc from the first ink drop that precedes the second ink drop (in fig.10, the interval between the consecutive ejecting pulses P2' is substantially equal to (1+1/2) x Tc ; in fig.11 the interval between the consecutive ejecting pulses P2" is equal to (1+1/2) x Tc; in fig.8, the interval between the consecutive ejecting pulses P2 is equal to (2+1/2) x Tc).

Regarding claim 6, Kusunoki '912 substantially teaches the claimed invention (see the rejections above and fig.9) except for the speed of one of the ink drops is set at

greater than 3 m/s, and at a speed at which the sequential ink drops are merged. It would have been obvious to one having ordinary skill in the art at the time the invention was made to eject an ink drop at greater than 3 m/s, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233

Regarding claim 7, Kusunoki '912 as modified by Matsuo et al. further teaches wherein four or more of the sequential ink drops merge during flight to form one of the relatively large ink drops (Matsuo et al in figs.7, and 14 teaches the merging of 3 ink droplets to form large ink drop Q123, figs.12b, 13b, 15b, 16b, 17b teaches how to select the required number of ejecting pulses that merges to from large ink drop. Thus it is obvious to form a large ink drop by merging four or more ink drops depending on the size of the large ink drop and the merging ink drops).

Regarding claim 8, Kusunoki '912 as modified by Matsuo et al further teaches a waveform containing driving pulses (figs.4, 8, 10,11of Kusunoki, figs.16, 17 of Matsuo et al) for discharging the sequential ink drops includes a waveform for suppressing a residual vibration after a driving pulse for discharging the last ink drop (S13 in fig.9, P15 in fig.11 of Matsuo et al).

Regarding claim 9, Kusunoki '912 as modified by Matsuo et al further teaches the waveform for suppressing the residual vibration (S13 in fig.9, P15 in fig.11 of

Matsuo et al) is provided within an elapsed time equivalent to Tc after the last ink drop is discharged (figs.4, 8, 10,11of Kusunoki).

Regarding claim 10, Kusunoki '912 as modified by Matsuo et al further teaches a medium-sized ink drop and a small-sized ink drop are each formed by selecting a part of driving pulses for forming the relatively large ink drop (in fig.14 Matsuo et al teaches small ink drops Q1 and Q2 forming a medium size drop Q12 and a small drop Q3 and medium drop Q12 forming large drop Q123).

Regarding claim 11, Kusunoki '912 as modified by Matsuo et al further teaches the driving pulses include a waveform for vibrating a meniscus without causing an ink drop to be discharged (S13 in fig.9, P15 in fig.11 of Matsuo et al).

Regarding claim 12, Kusunoki '912 as modified by Matsuo et al further teaches the driving pulses (figs.4, 8, 10,11of Kusunoki) include a section wherein a voltage is applied to the pressure generating means (15 figs.1-2) for pressurizing ink in the pressurized ink chamber (11) (see also figs. 6-9,11,16 of Matsuo et al).

Regarding claim 13, Kusunoki '912 as modified by Matsuo et al further teaches the pressure generating means (15,figs.1,2 of Kusunoki) is a piezoelectric device, and the piezoelectric device (15) is recharged in the section wherein said voltage is applied (figs.4, 8, 10,11).

Regarding claim 14, Kusunoki '912 as modified by Matsuo et al further teaches wherein the pressure generating means (15, figs.1, 2 of Kusunoki) for generating the pressure for pressurizing the ink of the pressurized ink chamber is a piezoelectric device, a displacement direction of which is d33 (see figs.4, 8, 10, 11; chamber 11 is contracted in inward direction when pulses P2 are applied to pressure generating means 15).

Regarding claim 15, Kusunoki '912 as modified by Matsuo et al further teaches support sections (14, figs.1, 2 of Kusunoki; 15 in fig.5 of Matsuo et al) of the piezoelectric device (15 figs.1, 2 of Kusunoki; 13 in fig.5 of Matsuo et al) support partitions of the pressurized ink chamber (11 figs.1, 2 of Kusunoki; 4 in fig.5 of Matsuo et al).

Regarding claim 16, Kusunoki '912 as modified by Matsuo et al further teaches wherein additional ink drops other than the one or more ink drops that are discharged at an interval substantially equal to (n+1/2) x Tc are discharged at an interval substantially equal to n x Tc, and said additional ink drops merge with the one or more ink drops that are discharged at an interval nearly equal to (n+1/2) x Tc (see fig.10, the interval between the consecutive ejecting pulses P2' is substantially equal to (1+1/2) x Tc ; see fig.11 the interval between the consecutive ejecting pulses P2" is equal to (1+1/2) x Tc; see fig.8, the interval between the consecutive ejecting pulses P2 is equal to (2+1/2) x

Tc. See also fig. 4, the interval between the consecutive ejecting pulses P2 is equal to 2 x Tc; Furthermore, in figs.8, 10, 11, the intervals 2.5 x Tc, 1.5 x Tc, 1.5 x Tc respectively which are substantially equal to n x Tc).

Regarding claim 17, Kusunoki '912 as modified by Matsuo et al further teaches wherein a predetermined interval between first and second ink drops of the sequential ink drops is substantially equal to1.5 x Tc such the first and second ink drops merge before reaching a print target medium (see fig. 4, the interval between the consecutive ejecting pulses P2 is equal to 2 x Tc; Furthermore, in figs.8,10,11, the intervals 2.5 x Tc, 1.5 x Tc, 1.5 x Tc respectively are also equal and/or substantially equal to 1.5 x Tc).

Response to Arguments

8. Applicant's arguments filed 06/16/2008 have been fully considered but they are not persuasive:

Applicant argued that reference Kusunoki '671 does not disclose or suggest discharging one or more of the ink drops other than the last ink drop in a given printing cycle, at an interval substantially equal to (n x Tc) + (Tc/2).

However, as discussed in the rejection of claim 1 above, Kusunoki '671 teaches ejection of sequence of ink drops at interval nxTs and the value of nxTs is <u>substantially</u> equal to (n+0.5) x Tc which can also be rewritten as (n x Tc) + (Tc/2) for an integer n

that is equal to or greater than 1, especially for high values of n. Applicant's attention is directed to the rejection of claim 1 above in view of Kusunoki '671.

Applicant argued with regard to references Ishikawa and Matsuo that; Ishikawa does not disclose or suggest that such timing can obtain beneficial results when it is used to form sequential ink drops that merge before reaching a print target medium. Applicant further argued that Matsuo does not disclose or suggest that advantageous results can be obtained by discharging the ink drops other than the last ink at an interval substantially equal to (n x Tc) + (Tc/2), when sequential ink drops merge before reaching a print target medium, and even with knowledge of Matsuo, one skilled in the are would not have looked to modify the apparatus proposed by Ishikawa to obtain a modified apparatus for discharging sequential ink drops wherein the sequential ink drops merge before reaching a print target medium, since such modification would have entailed a substantial overhaul of the design of the image forming apparatus.

However, as clearly discussed in the 103 rejections in view of Ishikawa and Matsuo; Ishikawa teaches the claimed sequence of ink drops interval of substantially equal to (n x Tc) + (Tc/2) which can be rewritten as (n+1/2) x Tc. Matsuo teaches merging of sequence of ink drops before reaching a print target medium by adjusting different methods. One of the different methods discussed by Matsuo is by simply adjusting the magnitude of the applied voltage to create large ink drops by the merging (see in particular figs.16, 17). Applicant's attention is further directed to the rejections in view of Ishikawa and Matsuo.

Similarly, applicant argued that the teachings of Matsuo and Kusunoki'912 can not be combined for same reasons the teachings of Matsuo and Ishikawa can not be combined as discussed above. However, same teachings of Matsuo discussed above are used in the 103 rejections in view of Kusunoki'912 and Matsuo. Applicant's attention is further directed to the rejections in view of Kusunoki'912 and Matsuo.

Furthermore, in response to applicant's argument that the Ishikawa and Kusunoki'912 can not be, is not obvious, modified by the teachings of Matsuo, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

In addition, in response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to HENOK LEGESSE whose telephone number is (571)270-1615. The examiner can normally be reached on Mon.- Fri. Between. 8:00 AM-6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, MATTHEW LUU can be reached on (571)272-7663. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/LUU MATTHEW/
Supervisory Patent Examiner, Art Unit 2861

H.L.
10/08/2008